1456 Issued August 2, 1912.

U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 504.

Experiment Station Work.

LXX.

Compiled from the Publications of the Agricultural Experiment Stations.

MAY, 1912.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.
A. C. TRUE, Director.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1912.

THE AGRICULTURAL EXPERIMENT STATIONS.

ALABAMA—
College Station: *Auburn;* J. F. Duggar.[1]
Canebrake Station: *Uniontown;* L. H. Moore.[1]
Tuskegee Station: *Tuskegee Institute;* G. W. Carver.[1]

ALASKA—*Sitka:* C. C. Georgeson.[2]

ARIZONA—*Tucson;* R. H. Forbes.[1]

ARKANSAS—*Fayetteville:* C. F. Adams.[1]

CALIFORNIA—*Berkeley:* E. J. Wickson.[1]

COLORADO—*Fort Collins:* C. P. Gillette.[1]

CONNECTICUT—
State Station: *New Haven;* E. H. Jenkins.[1]
Storrs Station: *Storrs;* L. A. Clinton.[1]

DELAWARE—*Newark;* H. Hayward.[1]

FLORIDA—*Gainesville:* P. H. Rolfs.[1]

GEORGIA—*Experiment:* Martin V. Calvin.[1]

GUAM—*Island of Guam:* J. B. Thompson.[2]

HAWAII—
Federal Station: *Honolulu;* E. V. Wilcox.[2]
Sugar Planters' Station: *Honolulu;* C. F. Eckart.[1]

IDAHO—*Moscow:* W. L. Carlyle.[1]

ILLINOIS—*Urbana:* E. Davenport.[1]

INDIANA—*La Fayette:* A. Goss.[1]

IOWA—*Ames:* C. F. Curtiss.[1]

KANSAS—*Manhattan:* E. H. Webster.[1]

KENTUCKY—*Lexington:* M. A. Scovell.[1]

LOUISIANA—
State Station: *Baton Rouge;*
Sugar Station: *Audubon Park, New Orleans;*
North La. Station: *Calhoun;*
Rice Station: *Crowley;*
} W. R. Dodson.[1]

MAINE—*Orono:* C. D. Woods.[1]

MARYLAND—*College Park:* H. J. Patterson.[1]

MASSACHUSETTS—*Amherst:* W. P. Brooks.[1]

MICHIGAN—*East Lansing:* R. S. Shaw.[1]

MINNESOTA—*University Farm, St. Paul:* A. F. Woods.[1]

MISSISSIPPI—*Agricultural College:* E. R. Lloyd.[1]

MISSOURI—
College Station: *Columbia;* F. B. Mumford.[1]
Fruit Station: *Mountain Grove;* Paul Evans.[1]

MONTANA—*Bozeman:* F. B. Linfield.[1]

NEBRASKA—*Lincoln:* E. A. Burnett.[1]

NEVADA—*Reno:* G. H. True.[1]

NEW HAMPSHIRE—*Durham:* J. C. Kendall.[1]

NEW JERSEY—*New Brunswick:* J. G. Lipman.[1]

NEW MEXICO—*State College:* Luther Foster.[1]

NEW YORK—
State Station: *Geneva;* W. H. Jordan.[1]
Cornell Station: *Ithaca;* L. H. Bailey.[1]

NORTH CAROLINA—
College Station: *West Raleigh;* C. B. Williams.[1]
State Station: *Raleigh;* B. W. Kilgore.[1]

NORTH DAKOTA—*Agricultural College:* J. H. Worst.[1]

OHIO—*Wooster:* C. E. Thorne.[1]

OKLAHOMA—*Stillwater:* J. A. Wilson.[1]

OREGON—*Corvallis:* J. Withycombe.[1]

PENNSYLVANIA—
State College: T. F. Hunt.[1]
State College: Institute of Animal Nutrition, H. P. Armsby.[1]

PORTO RICO—
Federal Station: *Mayaguez;* D. W. May.[2]
Sugar Planters' Station: *Río Piedras;* J. T. Crawley.[1]

RHODE ISLAND—*Kingston:* H. J. Wheeler.[1]

SOUTH CAROLINA—*Clemson College:* J. N. Harper.[1]

SOUTH DAKOTA—*Brookings:* J. W. Wilson.[1]

TENNESSEE—*Knoxville:* H. A. Morgan.[1]

TEXAS—*College Station:* B. Youngblood.[1]

UTAH—*Logan:* E. D. Ball.[1]

VERMONT—*Burlington:* J. L. Hills.[1]

VIRGINIA—
Blacksburg: S. W. Fletcher.[1]
Norfolk: Truck Station, T. C. Johnson.[1]

WASHINGTON—*Pullman:* R. W. Thatcher.[1]

WEST VIRGINIA—*Morgantown:* E. D. Sanderson.[1]

WISCONSIN—*Madison:* H. L. Russell.[1]

WYOMING—*Laramie:* H. G. Knight.[1]

[1] Director.

[2] Special agent in charge.

EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

CONTENTS OF NO. LXX.

ILLUSTRATIONS.

EXPERIMENT STATION WORK.[1]

IMPROVEMENT OF SANDY SOILS—GROWTH OF FORAGE CROPS.[2]

In 1904 the New Jersey Experiment Stations undertook experiments at Hammonton on the light sandy soils of southern New Jersey which had as their object the working out of methods of cropping and fertilizing by which the farmers on such soils might secure a sufficient supply of succulent forage for their cattle and gradually improve the productive capacity of the soil.

The soil experimented upon was typical light sandy soil which holds water "but indifferently well" and dries out rather quickly. It is representative of about 2,000,000 acres in New Jersey and of large areas in other States of the South Atlantic seaboard.

The soil used in the experiments had in previous years received applications of both manure and fertilizers, but was not very productive. In preparing the soil for the experiments the following materials were applied: Lime 1,000 pounds, acid phosphate 320, ground bone 100, muriate of potash 160, and dried blood 150 pounds per acre. In addition to these, three of the plats received each 16 pounds of nitrate of soda, or at the rate of 80 pounds per acre, applied as a top dressing after the plants were well started. The crops were arranged so as to provide a reasonably uniform supply of forage.

The crops grown included corn, wheat, rye, barnyard millet, wheat and vetch, rye and vetch, oats and vetch, cowpeas, soy beans, red clover, crimson clover, alfalfa, beets, and mangels. Two crops were harvested annually from each plat.

More than half of the crops were either legumes or a mixture of legumes and nonlegumes. The legumes included five crops of crimson clover, four crops of cowpeas, three crops of soy beans, six crops of vetch grown alone, or together with rye, wheat or oats, and single crops of red clover and of alfalfa. The crimson clover, cowpeas, and vetch all grew splendidly when the seasonal conditions were favorable, and proved themselves well adapted for supplying generous amounts of animal food, and for adding to the store of nitrogen and humus in the soil. The frequent growing of legumes served a twofold purpose. It permitted larger yields of protein, since these crops are particularly rich in nitrogenous constituents. It permitted, also, the fixation of large amounts of atmospheric nitrogen by means of these crops, and the

[1] A progress record of experimental inquiries published without assumption of responsibility by the department for the correctness of the facts and conclusions reported by the stations.

[2] Compiled from New Jersey Sta. Bul. 211.

addition of a part of it to the soil. With a plentiful supply of phosphoric acid, potash, and lime there was thus no difficulty at all in obtaining the nitrogen for the soil and the protein for the animals at comparatively slight expense. * * * Succulent foods for the animals were available for a considerable portion of the growing season. Of course, no attempt was made to establish a complete soiling system, it being the purpose of the experiments to demonstrate merely that such a system may be made both practicable and profitable on the sandy soils of South Jersey.

The initial outlay for fertilizers ranged from $11.92 to $13.52 per acre. The cost of subsequent applications was small, not exceeding about $4 in 1905 and 1906. The value of the crops produced, less the cost of fertilizers, was $20.01 in 1904, $46.92 in 1905, $64.07 in 1906, and $76.90 in 1907. It is thus seen that—

The returns from the land showed a gradual and marked increase. Excluding those of 1904, when only one crop was secured, the value of the crop in 1905 exceeded the cost of fertilizer by $46.92. The gain in 1906 was $64.07 and in 1907 $76.90. No attempt is made here to allow for the cost of seed and labor, for it was the purpose of the experiment to demonstrate merely that the growing of forage crops on light soils may be made both practicable and profitable, while increasing at the same time the productive capacity of the land. The valuation placed on the crops, which we believed justified by local conditions, may be considered excessive in other localities. This would, however, in nowise affect the main points under discussion. Whatever the value of the crops under varying market conditions, it still remains true that the land has improved and that the crop yields have proved profitable. From the standpoint of forage production the problem has been solved in a most gratifying manner, and the method as followed on the experiment plats can be applied, therefore, just as successfully on larger areas of similar land. * * *

The experiments prove convincingly that it is possible and practicable to grow forage crops for the dairy on the light, sandy soils of South Jersey; that two crops may be easily harvested each season; that the purchase of organic matter for maintaining the soil humus is not necessary; that the purchase of nitrogen may be largely dispensed with; that this method assures the accumulation of organic matter in the soil and an improvement in its physical properties; that with proper management it may be made to provide for the accumulation of nitrogen, phosphoric acid, and potash in the soil. It may be especially noted in this connection that the gratifying results secured are due in great part to the large proportion of leguminous crops grown. Indeed, the cowpeas and crimson clover, which grow so splendidly on this type of soil, have shown very marked improvement.

From these results it is considered not unreasonable to assume that by systematic cropping and fertilizing millions of acres of sandy soils in New Jersey and other States of the South Atlantic seaboard now uncultivated and unproductive may be profitably utilized "for dairy purposes to supply local needs, and to furnish, besides, a supply of dairy products for the large centers of population more or less distant. * * * They emphasize once again that these lands have before them a prosperous future, and that some day they are destined to be the scene of intelligent farming and of highly profitable returns, where at present they are scarcely tilled at all."

UTILIZATION OF ROUGHAGE.[1]

A recent bulletin of the Indiana station contains the significant statement that "one of the greatest losses on the farm is due to the lack of proper utilization of roughage incidental to grain production."

There are produced upon the farm large quantitles of rough feeds that do not hring, on the market, prices to justify the removal of such quantities of plant food as of necessity accompanies the sale of such products. Therefore one of the greatest problems to he solved in successful farm management is the disposal of the roughage produced on the farm in such a way as to secure the feeding value and at the same time conserve the plant food therein contained.

It is explained that—

It is impossihle to produce grain without also producing large amounts of roughage. Since cattle are preemiuently the most satisfactory animals to consume large quantities of roughage, the solution of the roughage problem lies largely with this class of stock, and with it rests the real value of the roughage grown on the farm. Cattle feeding is coming more and more to be considered as a means of marketing grain, conserving soil fertility, and completely utilizing the roughage produced on the farm rather than a means of commercial speculation.

J. H. Skinner and his associates, of the Indiana station, have for several years been investigating "the most efficient methods of feeding the crops produced on the farm, and especially the utilization of the various kinds of roughage." They have experimented particularly with corn silage and clover hay as roughage.

The use and value of clover hay is pretty well recognized and understood, hut the use and value of the cornstalk is neither understood nor appreciated. It has long heen known that the stalks contain a very large percentago of the food nutrients of the corn plant. When harvested to preserve the grain only, the stalks, either standing or as corn stover, while containing the food nutrients, havo them locked in such a way with woody fiber that they are not readily available for animals. The woody parts are not only unpalatable but when eaten require so much energy in digestion that a large part of their value is lost. When harvested, hy putting the entire plant into the silo the plant passes through a process of fermentation that leaves the hard parts of the stalk soft and palatable, and the general effect of summer grass is secured in winter hy feeding the corn silage. When fed in the form of silage, the entire corn plant is consumed.

In the experiments at the Indiana station it was found that corn silage was a more economical and more profitable roughage than clover hay alone for fattening cattle. Addition of silage to a ration of shelled corn, cottonseed meal, and clover hay decreased the consumption of shelled corn in amounts closely approximating the grain content of the silage in the ration. Addition of silage to a ration of shelled corn, cottonseed meal, and clover hay increased the rate and decreased the cost of gain and finished the cattle equally well. Silage added to a ration of shelled corn, cottonseed meal, and clover hay increased the profits per steer in amounts closely corresponding to the saving in cost of gains.

[1] Compiled from Indiana Sta. Bul. 153.

The substitution of corn silage for clover hay with grain rations of corn and cottonseed meal did not affect the rate of gain, but did greatly reduce the cost of gain. Corn silage alone as roughage, with a grain ration of shelled corn and cottonseed meal, gave slightly less finish than clover hay alone as roughage, but the cost of gains was enough less to return a much larger profit where silage was the only roughage fed. The more nearly corn silage replaced the clover hay in the ration the cheaper the gain, but the entire elimination of clover hay from the ration was accompanied by slightly less finish on the cattle.

Under prevailing market conditions the larger the proportion of corn silage in the roughage, in the early part of the fattening period, the cheaper were the gains. To induce sufficient grain consumption to insure satisfactory gains it was necessary to limit the amount of silage fed during the latter part of the feeding period. Corn silage in the ration produced relatively more rapid improvement in the condition of the cattle during the early part of the fattening period than did clover hay alone as roughage. The consumption of frozen silage scoured the cattle.

The results in general "indicate very strongly that the more nearly the clover hay is replaced by corn silage the greater is the reduction in the cost of making gains, but that for the latter half of the fattening period the roughage must be limited to such amounts that enough grain will be eaten to return satisfactory gains. Otherwise there will be a lack of finish on the cattle that will partially or entirely overcome the advantage derived from the more economical gains."

With these precautions it appears that the substitution of silage in part for clover is an economical method of utilizing roughage on the farm.

FATTENING LAMBS ON ALFALFA AND CORN.[1]

It is perfectly logical and there is a growing tendency to finish lambs where they are produced, although the practice of shipping lambs to distant places to be finished for market is still common. This is typically exemplified in the case of New Mexico, which, though ranking probably fourth among the States in production, ships most of its lambs to distant points to be finished for market. With improved local markets and increased production of feeds, however, attention is being turned to home finishing of the lambs. H. H. Simpson, of the New Mexico station, therefore undertook to determine the best way to utilize the available feeds of the State in the finishing of range lambs. As the most abundant feed available alfalfa was used alone or as the basis of the rations fed, being supplemented in

[1] Compiled from New Mexico Sta. Bul. 79.

some cases with varying amounts of shelled corn (one-fourth, one-half, and 1 pound per day.)

It was found that mutton of a quality suitable for the local market demands could be produced with alfalfa hay alone and that the feeding of lambs is profitable if dealers are willing to pay the same price for the home-fed product that they must pay for the imported article of equal quality. The addition of corn improved the quality of the mutton and shortened the feeding period. The general conclusion is that with alfalfa hay alone it requires about 110 to 120 days to fit the lambs for the local market, with light grain ration (one-fourth pound per head per day) 100 to 110 days, with medium grain ration (one-half pound) 90 to 100 days, and with heavy grain ration (1 pound) 70 to 80 days. Gains were as great (but not as rapid) with one-fourth pound of corn per head daily as with one-half pound. The cost of gain increased with an increase in the grain ration.

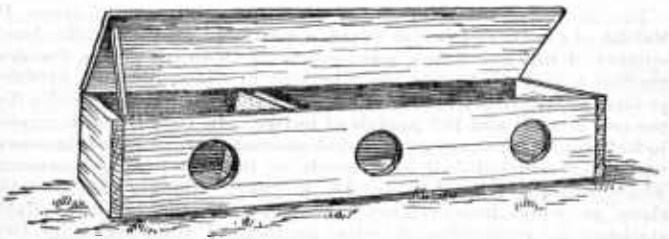

FIG. 1.—Box for feeding alfalfa hay to swine.

BOX FOR FEEDING ALFALFA HAY TO SWINE.[1]

In connection with a report by G. E. Morton, of tests at the Wyoming station, of the value of alfalfa hay for pig feeding under different conditions some data are given regarding a method of feeding which is designed to prevent losses. A box about 6 feet long, 20 inches wide, and 20 inches deep, with a cover, is used, with 3 round openings about 10 inches in diameter on the front side with a space of about 10 inches between the openings. Figure 1 plainly shows the construction of the feed box, which should be built of inch stuff. When filled the cover is closed and pigs can only gain access to the hay through the openings on the front of the box and so can not trample and waste it. Furthermore, the use of such a feed box prevents the loss of the alfalfa leaves which drop from the stalks very readily when the hay is handled.

[1] Compiled from Wyoming Sta. Bull. 74.

Such a feeding box has a disadvantage in that the openings must be made of suitable size for either light or heavy pigs. If too small, the large hogs can not get at the hay, while if they are large shoats can readily waste hay through the openings. However, in general the box is certainly of advantage in regions where rain or snow is of frequent occurrence as it keeps the alfalfa hay dry in addition to lessening waste.

Prof. Morton states (in a letter) that for other conditions different sorts of racks are desirable and that at the Colorado station a V-shaped slatted rack, similar to those used for feeding sheep, has given good satisfaction. The rack is so constructed that the base rests on the ground and troughs project from the base about 6 inches beneath the slats so that any leaves pulled out will drop into the troughs and be eaten.

COOPERATIVE HERD TESTING.[1]

In a review of the work of cow-testing associations in Europe, H. Rabild, of the Dairy Division of this department, states that the development of this movement, particularly in Denmark and in Sweden, marked a period of great improvement in the production of dairy products. Reports from Denmark show that the average production per cow in 1884 was 112 pounds of butter. In 1908 it had increased to 224 pounds, or exactly twice that amount. Much of this improvement was accomplished as a result of the cow-testing movement which was begun in that country in 1892. Reports from Sweden show an equal improvement. According to the latest available statistics the production of butter fat in the United States for 1909 was probably not over 180 pounds per cow. When it is remembered that there are large numbers of cows which produce from 400 to 500 pounds of butter fat, and some reaching as high as 900 pounds, the feasibility of increasing the production becomes quite apparent.

The improvement of a herd in productive capacity must be based fundamentally on a knowledge of the amount of milk and butter fat produced and the amount of feed consumed per cow. Experiments have shown that the record of the scales and Babcock test is the best means to this end. That such tests in the past have worked a great improvement in the productive capacity of individual herds by enabling the farmer to weed out intelligently the poor cows can not be questioned. It is equally true, however, that there remains a great majority of cases where herds have not been tested, probably not because the dairyman questions the accuracy of the method but because testing is tedious work and is apt to be neglected under the pressure of other duties. To offset this difficulty, as well as to improve

[1] Compiled from Virginia Sta. Bul. 190; U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1909, pp. 99-118.

the general efficiency of the tests, there have been organized within the last few years cow-testing associations in several different States under the general supervision of the Dairy Division of this department. The first of these was formed at Fremont, Newaygo County, Mich., in 1905. Since then the number has grown to 90, comprising owners of about 38,250 cows.

At the Virginia Experiment Station tests were made of the productive capacity of the herds supplying milk to the college creamery. "In all herds the cost of feed was estimated. In the five herds tested there were 70 cows, none of which was pure bred; all were grades. Scarcely half of them could be considered of good dairy type. The average yearly milk production of the 70 cows was 4,113 pounds, having an average of 180.2 pounds of butter fat. The average net profit from each of these 70 cows was $23.15, after deducting the estimated cost of food and labor and crediting the estimated value of the manure.

Only 4 per cent of the cows in these herds gave a net profit of $50 per year, which is considered by good dairymen as the profit that may reasonably be expected from good cows comfortably housed and intelligently fed, when the products can be sold to advantage. In fact, but 34 per cent of these cows gave a net profit above $30 per year, while 4 per cent were kept at an actual loss to the owners. These results may be taken as representative of the conditions existing in most sections of Virginia.

The estimated loss during the winter from inadequate feeding in three herds, comprising 26 cows, thereby causing a shrinkage of milk, was $143.50, or a total loss of $5.52 per cow. This record may be compared with the record of the college herd of 15 cows, which during the same winter showed a loss from shrinkage of milk of but $15.05, or $1 per cow. The loss from shrinkage in winter, due to poor feeding, would amount to $400,000 a year if one-third of the 300,000 milch cows of Virginia are producing milk in winter.

The results obtained from this, the first "cow-testing association" in operation in Virginia, show conclusively conditions which are of practical interest to the dairymen of the State. A relatively small percentage of cows in milk are making a satisfactory profit, some are barely paying for feed and labor, while others are kept at a positive loss. The average herd owner is not aware of these conditions until it is called to his attention by tangible records. It is assumed that no man would keep a cow at a loss if he were aware of the fact, and still such cows exist in nearly all herds. * * *

For all practical purposes we have found that if the milk is weighed for three consecutive days in each month, and the milk tested for butter fat two or three times during the lactation period, that reasonably reliable results are obtained. One herd from which milk was weighed daily gave yearly totals that were only eighty-three one-hundredths of 1 per cent different from the production as estimated by this method. * * *

Herds, as a whole, should be culled to a definite standard of excellence. The standard must vary according to such conditions as market prices of animals and products, availability of better stock, etc.; but, generally speaking, a standard of 6,000 pounds of milk and 300 pounds fat per year for Jerseys and Guernseys, 9,000 pounds of milk and 300 pounds fat for Holsteins, should be the aim of dairymen at first. When these records are reached, the standard may be raised.

In discussing the methods of organizing these cow-testing associations, Mr. Rabild states that—

The usual way of organizing an association has been to ascertain the extent of the interest in dairying in a community and to call a meeting and explain the merits of the cow-testing association as an institution. If enough interest is exhibited to warrant going on with the work, a temporary organization is effected, and the neighborhood is thoroughly canvassed during the following few days in search of additional members for the association. When enough have been secured a second meeting is called, at which the organization is perfected, officers elected, and by-laws adopted.

In order to support a cow-testing association it is necessary that there should be 26 herds, conveniently located, and a sufficient number of cows, so that the tester can get a reasonably good salary. As it is each member's duty to furnish the tester's conveyance to his next place of work, it is necessary that the farms of the members be located near enough together so he can be conveyed without inconvenience. A distance of 2 miles is not too great to give satisfaction, and the conveyance is often furnished by some passer-by. If the cow tester keeps his own horse and buggy, as is the case in some associations, a larger territory is usually accommodated. In such cases the members must furnish feed and stabling for his horse. The charge to the farmer is usually $1 a year for each cow. This money constitutes the pay of the tester; and it is desirable that there should be not less than 400 cows in an association, in which case the tester gets $400 a year. In addition he gets his board and lodging free of charge at the farm where he is working. There being only 26 working days in a month, it is not possible to have more than 26 members, except in cases where two men with small herds live very close together, so that it is possible to test both herds in one day. On such farms the regular milking time is fixed so that the tester can attend to the weighing and testing in the first herd and still have plenty of time to get to the second herd by the regular milking hour. In addition to the $1 a cow, the farmer pays a membership fee of 25 cents yearly. This money, which for 26 members amounts to $6.50, is used for paying incidental expenses, postage, cost of sulphuric acid, etc. * * *

Perhaps the most important result of the cow-testing associations is the increased interest which members take in their work. Farm work, consisting as it does in large part of manual labor, is apt to become monotonous unless there is an intelligent interest in the operations and unless the farmer has something special in view. The monthly visit of the cow tester stimulates this interest; and while the primary object for which the association was organized is the selection and rejection of individual animals, the results, direct and indirect, cover a very broad field.

The tester, being an expert dairyman, not only studies the individual animals in the herd as to their capacity for utilizing feed economically, but he also assists the farmer in selecting those feeds which contain the greatest amount of food nutrients at the lowest price, thereby creating a larger net return per cow, per acre, per dollar's worth of feed, and, last but not least, per man. This larger net return per cow is brought about not only by the increased yield of the cows, but by improved economy in the conversion of feed into finished product.

One of the direct results is improved breeding. Many testing associations have proved to be forerunners of breeding associations, or bull associations, for the development of pure-bred cattle of breeds particularly adapted to the local conditions.

The cow-testing movement, being an organized effort for improvement, is conducive to better community spirit. At the monthly meetings problems of interest to dairymen are discussed, and this discussion often stimulates a friendly rivalry for attainment of the best results. The systematic and cooperative effort creates an interest in the growing of better forage crops and in better feeding; in more sanitary stabling and better care of the milk; it opens the eyes of the farmers to the value of system in their work, and leads to the application of better business methods.

Cooperative buying of feeding stuffs is a feature in nearly all cow-testing associations. At the monthly meetings the members place in the hands of the board of directors an order for the amount of feed stuffs they wish to buy. The aggregate of these orders often amounts to several carloads, and by buying in carload lots and for cash lower prices and freight rates are obtained. The officers of the associations study the markets for feed stuffs and are often able to take advantage of a low market. In this way business judgment is stimulated and the individual member is enabled to reap the benefit of the business judgment of his more experienced coworkers.

The work, broad as it is, has value not only for the farmer, but also for the creamery and the cheese factory, since it encourages better dairy methods at the same time that it procures larger remuneration for the dairymen. One of the causes of dissatisfaction with creameries and cheese factories has been the low average production of dairy commodities. The farmer has not had any systematic performance record of the production of his individual cows, and it is natural for him to think that some one else besides himself is responsible for the low return, and the creamery or cheese factory manager, being the one who purchases his milk or cream, has received the blame. Many farmers have had only a half-hearted interest in dairying, because the average production of their herds has been so low that they could make but a small profit therefrom. The experience already gained in places where associations have been organized shows that with the elimination of the poor cows in the herd comes an interest in better cows and better care of the cows, and a tendency to make greater discrimination in price between good and poor animals. The introduction of better cows on the farms creates a desire for more of them, and a larger number of cows renders it possible for creameries and cheese factories to collect more milk or cream in a given territory, thus reducing the cost of collection.

The increased interest in dairying stimulates interest in dairy and kindred associations, and creates an interest in pure-bred stock. In the Newaygo County Dairy Testing Association, where during the first year only one man owned a pure-bred dairy bull, 22 such bulls were found among the herds during the second year; and while no pure-bred cows at all were owned in the first year, 21 were bought during the second year. This interest has steadily increased, and during the third year a breeding association was organized. Such increased interest in pure-bred stock naturally affects the market for such stock and entitles the movement to the hearty support of the breeders' associations of the different dairy breeds.

The consumer is interested not only in greater economy in the production of dairy commodities, but in improvement of their quality, which is promoted by sanitary stabling and better care of milk on the farm. These results follow from cow-testing associations wherever tried, and the consumer should for this reason give encouragement to such organizations.

COOPERATIVE CATTLE BREEDING.[1]

Coincident with the development of the work of cow-testing associations has been an interest in cooperative breeding, or circuit breeding, for the purpose of encouraging and facilitating the growing of pure-bred and high-grade dairy stock. The main centers of activity along this line of work of which reports are available have been in Maine, Minnesota, Michigan, and North Dakota.

The general plan of these associations in Maine is as follows: A community of farmers interested in the improvement of some one breed of cattle form an association binding themselves by an agree-

[1] Compiled from Michigan Sta. Circ. 4; U. S. Dept. Agr., Rpt. Chief Bur. Anim. Indus. 1911, p. 15; Amer. Breeders' Assoc. [Proc.], 6 (1909), pp. 285, 300, 301.

ment to advance the interests of that breed and to use only registered sires. The bulls are purchased by the association from among the best herds of the breed represented and are used on the herds of the members of the association, regardless of whether the cows are pure breds or grades, until such time as inbreeding would result. A general shift is then made, giving each member a new male without any additional expense. The most productive animal soon becomes known by the value of his get. If it is desired to sell pure-bred or high-grade stock for breeding purposes, advertising is done through the association and the sales are made by its agent.

The cooperative breeding of milking Shorthorns by the Minnesota Experiment Station, in cooperation with this department, was taken up in 1907. The associations are organized from among men who have bred and handled pure-bred Shorthorns for milk and beef production. Meetings are held twice a year to discuss matters of interest to the cooperators, to report progress made, and to suggest plans for improving the work. A circuit superintendent is employed who, under the direction of a council consisting of the president of the association, a representative of the Department of Agriculture, and a representative from the State experiment station, advises and directs the general management of the herds, and keeps records of feed consumed, milk produced, and breeding power of the animals in the circuit. He spends two days with each member, during which he weighs the milk produced by each cow and makes butter-fat determinations. From these and daily records kept by the owner the annual records of milk and butter-fat production are computed.

The Holstein cattle work at the North Dakota Experiment Station, in cooperation with this department, was begun in 1909. According to the annual report for 1911 of the Bureau of Animal Industry of this department, a year's record of all the cows in the herds was completed January 1 and showed that some of the pure-bred cows produced over 500 pounds of butter during the year.

The work by the Michigan station was inaugurated in 1908 under the direction of a field agent appointed by the State experiment station. During the first five months' work 10 cooperative associations were formed and 7 others were in process of formation. About 50 registered sires were introduced, and 2,100 cows which were bred to grade and scrub sires in 1907 were bred to registered bulls in 1908 and 1909. The following is a copy of the constitution and by-laws adopted by the Michigan associations:

ARTICLES OF AGREEMENT FOR ASSOCIATION (INCORPORATED).

ARTICLE 1. It should be the purpose of this association to procure and use pedigreed sires for the purpose of improving our live stock through a system of upgrading. This method of improvement implies the continued use of some one kind of pure blood on

the grade and mixed bred stock. The association opposes the admixture of the blood of several breeds and the use of cross-brod grade and scrub sires. The association also pledges itself to exert every possible influence for the improvement and furtherance of the live-stock interests of the community.

ART. 2. The name of this association shall be ——— ———.

ART. 3. The annual meetings of this association shall be held on the ———.

ART. 4. The officers of this association shall consist of a board of five directors, from which shall he elected a president, vice president, and a secretary-treasurer, whose term of office shall he one year, except the directors, whose term of office shall he three years. At the first meeting of this association there shall be elected one director to serve one year, two directors to serve two years, and two directors to serve three years.

ART. 5. The president shall preside at all meetings of the association and of the board of directors. He shall countersign all orders for money authorized by the association or board of directors. He shall sign all stock certificates and have general supervision of the affairs of the association.

ART. 6. In the absence of the president, the vice president shall have the same power and duties as the president.

ART. 7. The secretary shall keep a correct record of the proceedings of the association; also of the board of directors. He shall keep a debit and credit account of the financial transactions of this association. He shall furnish the caretakers of the sires of this association with books in which to record the service of each sire, together with the date of service, and the owner of the animal served.

He shall settle with the caretakers at least once in —— months, giving them a receipt for all money received from them. At the annual meeting of the association each year he shall give an itemized report of the business of the association for the past year, and at the expiration of his term of office shall turn over to his successor in office all books, papers, and all property in his possession belonging to the association. He shall draw and sign all orders for money on the treasurer authorized by the association or board of directors; also make out and sign all certificates of stock of the association.

As treasurer he shall give a good and sufficient hond with at least two sureties for twice the amount of money that may come into his hands in any one year. He shall pay all orders for money drawn and signed by the secretary and countersigned by the president. When in funds, he shall koep a debit and credit account of all moneys received and paid out by him for the association. He sball at the annual meeting of this association give a report of amounts of money received and paid out by him aud settle with the hoard of directors by producing vouchers for all money paid out.

ART. 8. The regular meetings of the hoard of directors shall he on the ———.

ART. 9. The board of directors shall have charge of all the business of the association, except in opposition of a majority vote of the stockholders of the association at regular or special meetings of the association.

ART. 10. Three directors shall constitute a quorum to do business, but a less number may adjourn to another date.

ART. 11. Special meetings of the association may he held on a call from the secretary hy notifying each stockholder at least 24 hours in advance of the meeting; also on petition of five stockholders to the secretary.

ART. 12. These articles of agreement may be amended at any meeting of the association hy a majority vote of those present and voting.

BY-LAWS GOVERNINO COOPERATIVE BREEDERS' ASSOCIATION.

(1) It shall be the duty of the officers of this association to purchase the necessary sires and negotiate with competent parties within the association, contrally located, to care for and handle the bulls at a sum not to exceed $——— per annum.

(2) All bulls must be purchasod subject to the tuherculin test as a safeguard against the introduction of tuberculosis.

(3) No bull or bulls or other breeding animals shall be purchased from any herd in which three or more cases of abortion have occurred during the past three years. (This will make reasonable allowance for accidental abortion and act as a safeguard against the ravages of contagious abortion.)

(4) Should any contagious or infectious disease appear in the herd of any member of this association he must forfeit the right to patronize males of the association until such time as his herd is declared free from disease by a competent veterinarian.

(5) A service fee of $1 shall be charged members of the association, to be collected at time of service. A charge of $2 will be made to nonmembers in case the association should decide to accept the patronage of the same.

(6) Service fees shall be used to defray cost of maintenance and handling of sires. Any surplus accumulations from this source may be divided among stockholders as dividends.

(7) It shall be the duty of the officers of this association to require and see to it that each sire is kept in a strong, vigorous, healthy condition, in moderate flesh, with plentiful supplies of suitable feed and sufficient yardage to afford ample exercise in the open air and sunshine in addition to the protection of the stable.

(8) Bulls shall not be used for service under 1 year of age, nor shall heifers be bred to calve under 24 months of age. During the rush of the breeding season single services only will be allowed.

In discussing the economic aspect of the work in cooperative breeding Assistant Secretary Hays, of this department, states that—

Cooperation in animal breeding, as in other forms of country-life cooperation, is a direct aid to the retention of the family farm, making less need for large farms and the consequent landlordism and peasantry of the people. Cooperation in testing and weeding out the ordinary herd used for production, in owning male animals, and in improving pure-bred families and breeds will enable farmers to delegate to collective management those things which the individual farmer can not well do for himself. If properly organized under suitable cooperative relations with the State and Federal departments of agriculture and encouraged by suitable laws, the heredity values of our breeds of live stock can be improved much more rapidly than if left to individual effort alone.

There doubtless are at stake some hundreds of millions of possible added profit from the application of scientific knowledge of animal breeding in the United States alone. That this science can best be applied under plans for the cooperation of breeders and State and National departments of agriculture there seems little doubt. Private breeders could do even much more than now if the scientific breeding of animals were taken in hand by public agencies cooperating with a selected portion of the breeders of each class of live stock. There will be developed a class of technical public workers as superintendents of cooperative breeding enterprises, as well as investigators and teachers, who will so develop the science and practice of breeding that all private breeders will better know how to improve their stock and will be better able to make profits from supplying superior breeding stock to the farmers who grow live-stock products. For any country to continue going forward in producing breeds without much system, showing the mere outward forms of the rare specimens at shows, and establishing the values of families by prizes and prices set on the fatted animals in the show and in the public sales ring and not get down to the bedrock of individual and herd performance records, would be suicidal. Breeding will become scientific in other countries. Any country not placing animal improvement on a scientific basis will be forced into the position of paying tribute to foreign countries for superior breeding animals. Each country, each State, and even each county where live stock is grown in quantity can and should have breeds or subbreeds of animals peculiarly bred for its conditions of soil, climate, and markets, with a surplus of pure-bred stock to be furnished at an extra profit to other communities.

LOSSES DUE TO LOW-GRADE CREAM.[1]

A recent circular of the Kansas station shows the close relation between the quality and price of butter and the quality and price paid for the cream from which it is made, and the large losses to the farmer resulting from the production of poor cream. The question is discussed with particular reference to Kansas conditions, but the statements have a much wider application and are therefore quoted quite fully below:

During the year 1911 Kansas dairymen and creamery men suffered a loss amounting to not less than $1,000,000 as a result of low prices paid for butter fat and received for butter. This loss was caused directly by the average quality of cream produced. Since the creameries could not make from this cream butter which would bring the highest possible price, they could not pay the highest price for butter fat. It must be said to the credit of the Kansas creameries that they employ the latest improved and most scientific methods of butter making and are able to make the best butter possible from the cream received. For these reasons and by superior sales methods they have given Kansas butter a satisfactory commercial standing and are netting the farmers better prices for butter fat than the same quality of cream would return if factory conditions were less highly developed. The burden of the million-dollar loss was sustained by the cream patrons, especially by those delivering the best cream; for their cream went into the same can with poor cream, and thus the best quality was brought down almost to the general average of the poor cream.

The market quotations which the farmer generally reads are those for the highest grades of butter. The Elgin market deals chiefly with the best quality of butter obtainable, but a small percentage only of all of the butter made comes up to the required standard of excellence. As a result, the prices paid for butter fat have generally been from 2 to 5 cents lower than the quotations for the best butter on the principal wholesale markets.

The production of more high-grade cream will not only result in better butter, which will bring a better price, but will create a further demand for Kansas butter and call the attention of the public to Kansas dairy products in general. To attract attention to the product of any locality invariably results in a greater demand for that product. Furthermore, if better butter can be made when prices are generally low, this butter will be in strong demand for storage purposes in the late spring and summer and will thus result in higher prices for cream when the largest quantity is being produced.

The Kansas Experiment Station has recently made a careful study of the cream situation and has found that a large percentage of the cream sold in the State is inferior in quality and will not make first-grade butter, but is made into a second-grade product and sold at a reduced price. The result of hundreds of tests has shown that cream which was kept in well water, running springs, and tanks of cold water, was on an average of a very good grade, but cream that was kept in cellars, caves, and uncooled or unventilated places was on an average of such poor quality that it would not make more than second-grade butter. Nevertheless, more than two-thirds of the cream produced was kept in the latter class of places.

The temperature tests showed that cream kept in wells and in places cooled by running water, or by water changed frequently, was less than 60° F. during the hottest days of July and August, 1911. The cream kept in cellars, caves, and other places not cooled by water, had an average temperature of 76° F. The dampness of cellars and caves is often mistaken for coolness.

[1] Compiled from Kansas Sta. Circ. 21.

Cream is contaminated with very small forms of life, such as bacteria, yeasts, and molds. The work of the Dairy Division of this department has shown that the development and the increase in number of this plant life which grows in cream is greatly retarded by keeping the cream at low temperature.

If cream is promptly cooled to a temperature of 40 to 45° F., which can be done by keeping the cans of cream in water cooled with ice, the development of acid and objectionable flavors will be slow and cream cooled in this way will remain sweet and in good condition for several days.

In sections of the country where a supply of natural ice is available, the practice of storing ice for cooling cream to a low temperature has generally proven satisfactory and profitable on account of the superior product produced. In localities where it is impracticable to secure ice for this purpose fairly good results have been obtained by setting cream in cold water provided it is changed frequently and has a temperature at or below 60° F. On the other hand, if the temperature rises to more than 75° the bacteria will multiply rapidly, causing the cream to sour quickly and to develop flavors which are usually very objectionable. Such cream can not be made into good butter.

In addition to the bad flavors caused by molds and bacteria, we have also a great deal of poorly flavored cream caused by the absorption of flavors from impure air. The butter fat in cream will very quickly absorb the odors given off by coal oil, spoiled vegetables, strongly flavored meats, and unclean stables; the butter fat is so sensitive to flavors that it also readily absorbs flavors of feed which cattle eat, such as weeds, spoiled silage, or musty hay.

The best results in the improvement of Kansas cream and butter can be brought about by paying for cream according to its quality. Just as the highest grade of butter on the market brings the highest price, so the highest grade of cream which will make the best butter should net the person producing it a better price than is paid for poorer grades. Cream should therefore be graded if the farmer is to be fairly recompensed for the cream he sells. This has never been successfully done, because it was difficult for everyone who buys cream to grade it properly and accurately according to its market value.

When we consider hand-skimmed cream, band-separator cream, water-separator cream, cream of different ages and of different flavors, lumpy cream and smooth cream, it would appear difficult to grade it accurately according to what it is worth, but, after working on the problem for several years, the Kansas Experiment Station has shown that the different flavors and qualities of cream correspond quite closely to its sourness, or the amount of acid which develops in cream. As a result of this work a simple, accurate test was devised by which cream can be graded according to its market value and in absolute fairness to all.

The standard for first-grade cream has been drawn at a point where cream is about twice as sour as sweet cream on the point of turning. Cream which comes in this class is said to be first grade, as it will make a very good grade of butter. In several communities the dairy farmers are now having their cream graded and are receiving 2 cents more for first-grade cream than for second-grade cream. In some communities

only two-thirds of the cream is first grade and in others nearly nine-tenths is first grade, depending on the way in which the farmers have been accustomed to care for their cream.

Those who are producing first-grade cream and are receiving the highest prices are interested in keeping their cream first grade, and those receiving the second-grade price, or 2 cents less, are endeavoring to take better care of it. The creameries buying the first-grade cream are obliged to pay more for it than for the general run of cream bought in other places, but they are just as willing to pay more as the farmers are to receive the extra premium money.

If good cream is worth more than poor cream, the man who produces it has a right to expect a higher price for it; and if his expectations are not fulfilled, he has a right to demand a higher price for it when his cream has been graded and shown to be first grade.

LESSENING DANGER FROM POISONING BY ARSENICAL DIPS.[1]

Arsenical dips are widely and successfully used as a means of exterminating the fever tick, as is fully explained in previous bulletins of the department.[2] The danger of poisoning in the use of such dips is, however, recognized in the bulletins referred to, which emphasizes the precautions necessary to avoid danger from this source in the process of dipping, as well as when the dipping vats containing the solution are not in use. It is pointed out that—

In addition to properly protecting vats containing arsenical dip when not in use, another precaution must be observed when vats are to be emptied for cleaning. The dip should not be poured or allowed to flow on land and vegetation to which cattle or other animals have access. The best plan is to run the dip in a pit properly protected by fences. The dip should also not be deposited where it may be carried by seepage into wells or springs which supply water used on the farm.

While, as pointed out by W. H. Dalrymple and A. P. Kerr in a recent bulletin of the Louisiana Experiment Stations, there need be little danger from poisoning if these precautions are carefully carried out by intelligent persons who are alive to the risk involved, "on account of the present extensive use of the arsenical dip, and the prospect of a still wider adoption of it throughout the South, and also the possibility of the disposal of the solution being delegated to some person or persons not sufficiently aware of the risk of water contamination, through ignorance or otherwise," it would appear "that if some simple, inexpensive, and effective method could be employed to render the arsenic in solution in the vat inert or harmless, it would add considerably to the safety of the solution which had to be disposed of when the cleaning of the vat was undertaken."

It was found in the course of experiments at the Louisiana station that the danger of poisoning, and especially of contamination of the water supply, could be minimized by treating the dip with air-slaked lime and commercial copperas, whereby the arsenic was precipitated

[1] Compiled from Louisiana Stas. Bul. 132.

[2] U. S. Dept. Agr., Farmers' Buls. 378, 498.

in a form insoluble in water. The method of procedure is described as follows:

After adding the lime, the mixture should be thoroughly agitated or stirred and allowed to stand for at least one hour. The copperas should first be dissolved in hot water, and, while still hot, should be added, somewhat slowly, to the contents of the vat, and the whole again stirred and then permitted to remain still for 10 or 12 hours, or overnight. At the expiration of this time, the clear solution on top may be siphoned or pumped to any convenient place without danger, as it should contain no arsenic whatever; and the precipitate, or sediment, afterwards removed and buried in a hole or small pit, if thought necessary, although it, too, should be harmless or inert, as the arsenic has been changed to a condition that is insoluble in water.

It was found that 3 pounds of air-slaked lime and 3 pounds of copperas were sufficient for 40 gallons of the dipping solution.

In order to make the calculation as simple as possible, it may be figured out for each 100 gallons of the arsenical solution left in the dipping vat at the time it is to be cleaned. For this quantity of solution, 6 pounds each of air-slaked lime and commercial copperas should be ample, as it was calculated to an excess. Or, in other words, for each 100 gallons of the arsenical solution left in the vat, 6 pounds each of air-slaked lime and common commercial copperas should be used.

In building concrete dipping vats, it would be well to have marks on the inside indicating each 100 or 200 gallons, so that a more or less accurate estimate could be made of the remaining solution at any time.

Or, when a vat is being filled, the water could be measured as it is put in, and a measuring stick marked, after each 100 or 200 gallons had been added, which could afterwards be used for a similar purpose.

Or the quantity of solution could be ascertained by the use of the following rule:

Measure, in inches, the length at the top of the solution and also the bottom of the vat. Add these two numbers together and divide by 2 to get the average length. In the same way measure, in inches, the top width of the solution and the width of the bottom of the vat and divide by 2 to get the average width. Then measure the depth of the solution in inches. Multiply the average length by the average width and multiply the result by the depth. Divide the last result by 231 and the answer will be the number in gallons of solution left in the vat. Presuming that the quantity of solution left in the vat, including the sediment composed of manure and mud, should be 500 gallons, this would take 30 pounds each of air-slaked lime and copperas.

* * *

Air-slaked lime and copperas are quite inexpensive materials, and easily obtainable by anyone. The amounts suggested of the materials are sufficiently in excess to be effective in any strength of arsenical solution now in use.

This method is simple, effective, and inexpensive, and if adopted may be the means of preventing casualties from the careless disposal of the poisonous arsenical solution, especially when undertaken at the time of emptying the dipping vat for cleaning at the end of the season, or at other times by those who may not be conversant with its poisonous nature.

CARE OF FARM MACHINERY.[1]

As H. M. Bainer and H. B. Bonebright state in a bulletin of the Colorado station—

To properly care for the farm machinery means that it must be well selected, kept in good repair and adjustment, oiled thoroughly, cleaned before housing, and it must have

[1] Compiled from Colorado Sta. Bul. 167.

all wearing parts well greased when not in use, and painted when necessary, and it must be properly housed.

At least one-half of "good care" consists in keeping the machinery properly repaired, in good adjustment, and thoroughly oiled when in use. To neglect any of the lines of care mentioned, means serious damage and loss to the machine.

If this be true it must be evident to any observant person that only a very small percentage of the farmers of the country properly care for their machinery. More give machinery good care when in use than properly care for it when not in use.

The fact that such a large percentage of the machinery is allowed to stand in the open is partly, but not wholly, explained by the marked scarcity of suitable machine sheds upon the farms. * * *

In a large number of cases the housing consists of "going through the motions" rather than actually preparing the machinery for storage and then properly storing it in a suitable shelter.

Machinery should be cleaned and oiled before storing.—Whether the machinery is to be housed or not, it should be cleaned and thoroughly oiled at the end of the season. With such machinery as the binder or mower, it is a good plan to thoroughly oil all bearings and wearing parts just before finishing the season. After removing all dirt, wipe the entire machinery with an oiled rag or waste. The wearing parts especially should be well greased with tallow or axle grease. If the entire machine is to be housed these wearing parts do not need to be removed from the machine, but they should be removed and stored in a dry place under all other conditions.

Housing the machinery—To house machinery does not always do as much good as is commonly supposed. In making the investigation, the following question was asked many times: "How should farm machinery be cared for?" It is usually answered by the farmer: "Everyone knows that it should be housed." This is a good answer as far as it goes, but to house machinery under any condition, and not properly care for it otherwise, constitutes very poor care.

Machinery may be just as well cared for if it is allowed to stand in the shade of a tree, as if it is stored in some of the leaky sheds, open sheds, poorly drained sheds, or combined machine sheds and hen roosts, such as were found during the investigation.

There is no question but that to properly house machinery is a great saving, as it not only adds a great deal to the life of the machine but it also adds to the general appearance of the farm. It was generally found that where a farmer was interested enough in his machine to properly house it, he was also interested enough in it to care for it otherwise.

The investigation showed that the life of farm machinery depended a great deal upon the owner. Individual farmers were found who took very good care of their machinery and left it in the weather, when not in use; others were found who gave their machinery very poor care and housed it when not in use. A great deal of housed machinery was found which had done no more work and was no better or older than some which had not been housed but which had been well cared for otherwise.

Cultivator shovels, plowshares, and attachments, which have been removed and greased, should be placed where there is no chance for them to get damp. It is a good plan to place them in a gunny sack and suspend them from the rafters of the shed or barn.

A great deal of farm machinery can be placed in a small space if properly arranged. At the time of storing the machinery it should be placed in the shed according to the time it will have to be removed. The machinery that will be used late during the following season should be placed in the back part of the shed and that which is to be used early in the season should be placed in front. In this way, it will not be necessary to remove a great deal of machinery in order to get what is needed first.

Figure 2 gives an idea of the amount of machinery which may be stored in a small shed if the man who stores it studies the problem thoroughly.

The following list of machinery was found in a two-story shed 20 by 30 feet. The shed has a small side door and a large double door at one end. On the first floor: A set of blacksmith tools with bench (repair work is done in the shed), riding plow, 2 cultivators, beet cultivator, binder, mower, grindstone, hayrake, grain drill, 2 smoothing harrows (2 sections each), slip scraper, and lister. On the second floor: A hay tedder (taken apart), several light tools, stoves (stored while not in use), some household goods, and other articles too numerous to mention. In case of large crops, grain is sometimes stored on the second floor of the shed.

The owner of the above-described shed unhesitatingly states that the shed is plenty large enough for the implements on 160 acres, providing the wagon and buggy can be stored in some other building.

The time required for storing this machinery and removing it each year is estimated by the farmer to be one-half day for himself and hired man.

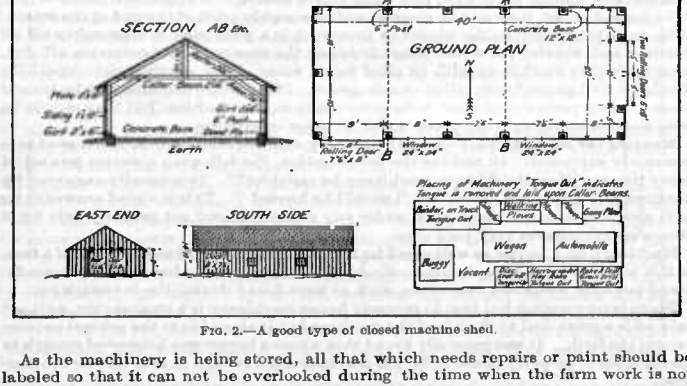

FIG. 2.—A good type of closed machine shed.

As the machinery is being stored, all that which needs repairs or paint should be labeled so that it can not be overlooked during the time when the farm work is not crowding.

Painting farm machinery.—There is no question but that it pays to keep the farm machinery thoroughly painted. This is especially true with such machinery as is largely constructed of wood. The paint fills all pores and cracks, prevents checking, prolongs the life of the machine and also adds very much to its appearance. Two or three dollars' worth of a good, reliable, ready-mixed paint for outside use, or carriage paint, applied each year to the machinery found on the average size farm will add many times the cost of the paint to the value of the machinery.

The implement house.—It is not always necessary or advisable to construct a special building for storing farm machinery. Often a very good place can be made in the barn or other buildings. By taking some of the parts off of certain machines, they can be easily stored in what otherwise might be waste space.

The characteristics of a good implement shed are:

(1) It must be thoroughly drained so the implements do not stand in a wet place.
(2) It must protect against sun, wind, and moisture.
(3) It must not be too expensive.
(4) It should be located in a convenient spot and so arranged as to be easily used.

The material from which the shed is made will depend upon the cost and the locality. In the investigation very good sheds were found which were of wood-frame construction, covered with sheet iron. Other good ones were found of wood-frame construction, sided with barn siding, drop siding, and in some places with ship-lap. Shingles or corrugated iron generally make the best roofs for machine sheds.

The shed illustrated in figure 2 was built on a Colorado farm and has been in use for several years. The owner makes a practice of storing his machinery as it should be.

The shed is built upon posts which rest upon concrete bases 12 by 12 inches. A strong iron dowel pin set in the concrete and projecting up into the post keeps the latter from slipping. The sides of the shed are 8 feet high. The roof is one-third pitch, shingled. Rafters 2 by 6 inches by 3 feet on center. The lower girt is 2 by 6 inches, the middle girt (placed just below the windows) is 2 by 6 inches, while the upper girt is 2 by 8 inches and serves as plate.

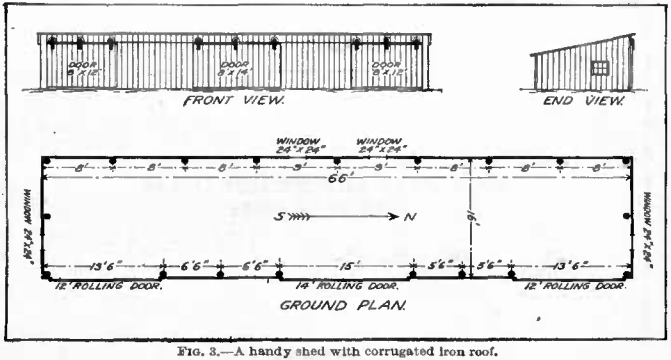

FIG. 3.—A handy shed with corrugated iron roof.

As the posts do not extend into the ground, it is necessary to brace the sides and ends of the shed. Braces also extend from the side posts to the collar beams, where the rafters come nearly over the posts. On the south side at the west end is a rolling door 7 feet 6 inches high by 8 feet long. At the east end the opening is 8 feet high by 10 feet wide. It is covered by two rolling doors 5 by 8 feet.

The sides are made of 12-inch stock boards. The cracks are covered with O. G. battens. The ground upon which the shed sits is about a foot higher than the surrounding ground. This gives a hard, dry dirt floor for the machinery.

In the lower right-hand corner of the drawing is shown the arrangement of the machinery in the shed. In some cases (marked "tongue out") the tongues are removed from the machines and placed upon the collar beams. The cultivator shovels, mower sickles, plowshares, binder canvasses, etc., are all greased and suspended from the collar beams. A large part of the machinery may be removed by simply running out the auto. In some cases the wagon must also be removed. The transport trucks are almost a necessity for the storage of a binder in this sort of a shed. The shed is painted with two coats of mineral red in oil.

The shed shown in figure 3 has actually been built by a Colorado farmer and is said to have proved very economical and satisfactory.

The only changes in the original plan is the addition of four small windows. The shed is 16 hy 66 feet. The posts are 10 feet high in front and 8 feet high in the rear, and are set in the ground 3 feet. There is no foundation for the shed.

These posts eliminate the necessity of a frame or braces. The bottom girt is 2 hy 6 inches, the middle girt 2 hy 4 inches, and the top girt, which also acts as plate, is 2 by 8 inches. The rafters are 2 by 6 inches, set 3 feet apart on centers. The sheathing is 1 hy 6 inches placed at the ends and in the middle of the sheets of corrugated iron which form the roof. At each end on the front side of the shed is located a 12-foot rolling door 8 feet high. Near the middle of the shed is a 14-foot door 8 feet high. These doors roll upon a continuous track which runs the entire length of the shed.

It becomes necessary to use a 2 hy 8 inch plate and a 2 hy 8 inch girt just above the doors to carry the weight of the doors.

The ground upon which the shed sits is about 8 to 12 inches higher than the surrounding ground. This gives a dry earth floor for the machinery.

The shed is painted with two coats of white lead in oil.